**PATENT**
**5049-07600**

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# AMUSEMENT PARK WATER LOCK SYSTEM AND METHOD OF USE

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# BACKGROUND OF THE INVENTION

## 1. Field of the Invention

The present disclosure generally relates to water amusement attractions and rides. More particularly, the disclosure generally relates to a system and method for transporting participants from a low elevation body of water to a higher elevation body of water using a lock system.

## 2. Description of the Relevant Art

The 80's decade has witnessed phenomenal growth in the participatory family water recreation facility, i.e., the waterpark, and in water oriented ride attractions in the traditional themed amusement parks. The current genre of water ride attractions, e.g., waterslides, river rapid rides, and log flumes, require participants to walk or be mechanically lifted to a high point, wherein, gravity enables water, rider(s), and riding vehicle (if appropriate) to slide down a chute or incline to a lower elevation splash pool, whereafter the cycle repeats. Gravity or gravity induced rider momentum is the prime driving force that powers the participant down and through these traditional water ride attractions.

For water rides that involve the use of a flotation device (e.g., an inner tube or floating board) the walk back to the start of a ride may be particularly arduous since the rider must carry the flotation device to the start of the ride. Additionally, many of the more popular waterpark rides may require a substantial waiting period, due to the large number of participants at the park. This waiting period is typically incorporated into the walk from the bottom of the ride back to the top. A series of corrals are typically used to form a meandering line of participants that extends from the starting point of the ride toward the exit point of the ride. The participants waiting in line to reach the starting point may become hot and impatient depending on the length of the wait.

It is therefore desirable to create a system for bringing participants of a water ride from a lower receiving pool back to the start of the ride without requiring the riders to leave the water. This would relieve the riders from the burden of carrying their floatation devices up to the start of a water ride. It would also allow the riders to stay in the water, thus keeping the riders cool while they are transported to the start of the ride.

## SUMMARY OF THE INVENTION

A water lock system may be used to allow participants to remain in water while being transported from a first body of water to a second body of water, the bodies of water being at different elevation levels. In one embodiment, the first body of water may be a body of water having an elevation below the second body of water. In an embodiment, the water lock system includes a chamber for holding water coupled to the first body of water and the second body of water. A chamber is herein defined as an at least partially enclosed space. The chamber includes at least one outer wall, or a series of outer walls which together define the outer perimeter of the chamber. The chamber may also be at least partially defined by natural features such as the side of a hill or mountain. The walls may be substantially watertight. The outer wall of the chamber, in one embodiment, extends below an upper surface of the first body of water and above the upper surface of the second body of water. The chamber may have a shape that resembles a figure selected from the group consisting of a square, a rectangle, a circle, a star, a regular polyhedron, a trapezoid, an ellipse, a U-shape, an L-shape, a Y-shape or a figure eight, when seen from an overhead view.

A first movable member may be formed in the outer wall of the chamber. The first movable member may be positioned to allow participants and water to move between the first body of water and the chamber when the first movable member is open during use. A second movable member may be formed in the wall of the chamber. The second movable member may be positioned to allow participants and water to move between the second body of water and the chamber when the second movable member is

open during use. The second movable member may be formed in the wall at an elevation that differs from that of the first movable member.

In one embodiment, the first and second movable members may be configured to swing away from the chamber wall when moving from a closed position to an open position during use. In another embodiment, the first and second movable members may be configured to move vertically into a portion of the wall when moving from a closed position to an open position. In another embodiment, the first and second movable members may be configured to move horizontally along a portion of the wall when moving from a closed position to an open position.

A bottom member may also be positioned within the chamber. The bottom member may be configured to float below the upper surface of water within the chamber during use. The bottom member may be configured to rise when the water in the chamber rises during use. In one embodiment, the bottom member is substantially water permeable such that water in the chamber moves freely through the bottom member as the bottom member is moved within the chamber during use. The bottom member may be configured to remain at a substantially constant distance from the upper surface of the water in the chamber during use. The bottom member may include a wall extending from the bottom member to a position above the upper surface of the water. The wall may be configured to prevent participants from moving to a position below the bottom member. A floatation member may be positioned upon the wall at a location proximate the upper surface of the water. A ratcheted locking system may couple the bottom member to the inner surface of the chamber wall. The ratcheted locking system may be configured to inhibit the bottom member from sinking when water is suddenly released from the chamber. The ratcheted locking system may also include a motor to allow the bottom member to be moved vertically within the chamber.

The lock system may also include a substantially vertical first ladder coupled to the wall of the bottom member and a substantially vertical second ladder coupled to a

wall of the chamber. The first and second ladders, in one embodiment, are positioned such that the ladders remain substantially aligned as the bottom member moves wertically within the chamber. The second ladder may extend to the top of the outer wall of the chamber. The ladders may allow participants to exit from the chamber if the lock system is not working properly.

In one embodiment, water may be transferred into and out of the water lock system via the movable members formed within the chamber wall. Opening of the movable members may allow water to flow into the chamber from the upper body of water or out of the chamber into the lower body of water.

In another embodiment, a first conduit may be coupled to the chamber for conducting water to the chamber during use. A first water control system may be positioned along the first conduit. The first water control system may be configured to control the flow of water through the first conduit during use. In one embodiment, the water control system may include a valve. The valve may be used to control the flow of water from a water source into the chamber. In one embodiment, the water source may be the first or second bodies of water. In another embodiment, the water control system includes a valve and a pump. The valve may be configured to inhibit flow of water through the conduit during use. The pump may be configured to pump water through the conduit during use.

In one embodiment, the first conduit may be coupled to the second body of water. In this embodiment, the first conduit may be configured to transfer water between the second body of water and the chamber during use. In another embodiment, the first conduit may be coupled to the first body of water. In this embodiment the first conduit may be configured to transfer water between the first body of water and the chamber during use. The first water control system may include a pump for pumping water from the first body of water to the chamber.

The lock system may also include a second conduit and a second water control system. The second conduit may be preferably coupled to the chamber for conducting water out of the chamber during use. The second water control system may be positioned along the second conduit to control flow of water through the second conduit during use.

The lock system may also include a controller for operating the system. The automatic controller may be a computer, programmable logic controller, or any other control device. The controller may be coupled to the first movable member, the second movable member, and the first water control system. The controller may allow manual, semi-automatic, or automatic control of the lock system.

In one embodiment, the participants may be floating in water during the entire transfer from the lower body of water to the upper body of water. The participants may be swimming in the water or floating upon a flotation device. Preferably, the participants are floating on an inner tube, a flotation board, raft, or other flotation devices used by riders on water rides.

In another embodiment, the lock system may include multiple movable members formed within the outer wall of the chamber. These movable members may lead to multiple bodies of water coupled to the chamber. The additional movable members may be formed at the same elevational level or at different elevations.

While described as having only a single chamber coupled to two bodies of water, it should be understood that multiple chambers may be interlocked to couple two or more bodies of water. By using multiple chambers, a series of smaller chambers may be built rather than a single large chamber. In some situations it may be easier to build a series of chambers rather than a single chamber. For example, use of a series of smaller chambers may better match the slope of an existing hill.

The participants may be transferred from the first body of water to the second

body of water by entering the chamber and altering the level of water within the chamber. The first movable member, coupled to the first body of water is opened to allow the participants to move into the chamber. The participants may propel themselves or be propelled by a current moving from the lower body of water toward the chamber. The current may be generated using water jets positioned along the inner surface of the chamber. Alternatively, a current may be generated by altering the level of water in the first body of water. For example, by raising the level of water in the first body of water a flow of water from the first body of water into the chamber may occur.

After the participants have entered the chamber, the first movable member is closed and the level of water in the chamber is altered. The level may be raised or lowered, depending on the elevation level of the second body of water with respect to the first body of water. If the second body of water is higher than the first body of water, the water level is raised. If the first body of water is at a higher elevation than the second body of water, the water level is lowered. As the water level in the chamber is altered, the participants are moved to a level commensurate with the upper surface of the second body of water. While the water level is altered within the chamber, the participants remain floating proximate the surface of the water. A bottom member preferably moves with the upper surface of the water in the chamber to reduce the risk of participants drowning. The water level in the chamber, in one embodiment, is altered until the water level in the chamber is substantially equal the water level of the second body of water. The second movable member may now be opened, allowing the participants to move from the chamber to the second body of water. In one embodiment, a current may be generated by filling the chamber with additional water after the level of water in the chamber is substantially equal to the level of water outside the chamber. As the water is pumped in the chamber, the resulting increase in water volume within the chamber may cause a current to be formed flowing from the chamber to the body of water. When the movable member is open, the formed current may be used to propel the participants from the chamber to a body of water. Thus, the participants may be transferred from a first body of water to a second body of water without having to leave the water. The





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participants are thus relieved of having to walk up a hill. The participants may also be relieved from carrying any flotation devices necessary for the waterpark rides.

The water lock system may be incorporated into a waterpark or amusement park to allow participants to move easily from lower bodies of water to upper bodies of water. In one embodiment, the water lock system may be positioned adjacent to one or more water rides. The water rides carry the participants from upper bodies of water to lower bodies of water. These upper and lower bodies of water may be coupled to the centrally disposed water lock system to carry the participants from the lower bodies of water to the upper bodies of water. In this manner, the participants may be able to remain in water during their use of multiple water rides.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which:

FIG 1. depicts a cross-sectional side view of a water lock system with one chamber and a conduit coupling the upper body of water to the chamber.

FIG. 2 depicts an overhead view of a rectangular lock system.

FIG. 3 depicts an overhead view of a U-shaped lock system.

FIG. 4 depicts an overhead view of a circular lock system.

FIG. 5 depicts an overhead view of an L-shaped lock system.

FIG. 6 depicts a perspective view of a lock system which includes swinging door movable member.

FIG. 7 depicts a perspective view of a lock system which includes a vertically movable member with the movable member in a closed position.

FIG. 8 depicts a perspective view of a vertically movable member moving to an open position.

FIG. 9 depicts a perspective view of a lock system which includes a vertically movable member with the movable member in an open position.

FIG. 10 depicts a perspective view of a lock system which includes a horizontally movable member with the movable member in a closed position.

FIG. 11 depicts a perspective view of a lock system which includes a horizontally movable member with the movable member in an open position.

FIG. 12 depicts a perspective view of a lock system which includes a bottom member.

FIG. 13 depicts a cross sectional side view of a bottom member disposed within a chamber of a lock system.

FIG. 14 depicts a perspective view of a ladder coupled to the wall and the bottom member.

FIG. 15 depicts a perspective view of a ratcheted locking mechanism.

FIG. 16 depicts a cross sectional side view of a water control system.

FIG. 17 depicts a cross sectional side view of a water lock system which includes one chamber and two conduits coupling an upper body of water to the chamber.

FIG. 18 depicts a cross sectional side view of a water lock system which includes one chamber and a conduit coupling a lower body of water to the chamber.

FIG. 19 depicts a cross sectional side view of a water lock system which includes one chamber and two conduits coupling a lower body of water to the chamber.

FIG. 20 depicts a cross sectional side view of a water lock system which includes a chamber, a first conduit coupling an upper body of water to the chamber, and a second conduit coupling a lower body of water to the chamber.

FIG. 21 depicts a cross sectional side view of a water lock system which includes a chamber, a first conduit coupling an upper body of water to the chamber, a second conduit coupling a lower body of water to the chamber, and a third conduit coupling the lower body of water to the upper body of water.

FIG. 22 depicts a cross sectional side view of a water lock system in which participants are being transferred from a lower body of water to a chamber.

FIG. 23 depicts a cross sectional side view of a water lock system in which the chamber is filled with water.

FIG. 24 depicts a cross sectional side view of a water lock system in which participants are being transferred from the chamber to an upper body of water.

FIG. 25 depicts a cross sectional side view of a water lock system which includes two chambers, a first conduit coupling an upper body of water to the first chamber, and a second conduit coupling the upper body of water to the second chamber.

FIG. 26 depicts a cross sectional side view of a water lock system which includes two chambers, a first conduit coupling a lower body of water to the first chamber, and a second conduit coupling the lower body of water to the second chamber.

FIG. 27 depicts a cross sectional side view of a water lock system which includes two chambers, a first conduit coupling an upper body of water to the second chamber, a second conduit coupling the second chamber to the first chamber, a third conduit coupling the second chamber to a lower body of water, and a fourth conduit coupling the lower body of water to the upper body of water.

FIG. 28 depicts a cross sectional side view of a water lock system which includes two chambers, a first conduit coupling an upper body of water to the first chamber, a

second conduit coupling the upper body of water to the second chamber, a third conduit coupling a lower body of water to the first chamber, a fourth conduit coupling a lower body of water to the second chamber, and a fifth conduit coupling the lower body of water to the upper body of water.

FIG. 29 depicts a cross sectional side view of a water lock system in which participants are being transferred from a lower body of water to a first chamber.

FIG. 30 depicts a cross sectional side view of a water lock system in which the first chamber is filled with water.

FIG. 31 depicts a cross sectional side view of a water lock system in which participants are being transferred from the first chamber to a second chamber.

FIG. 32 depicts a cross sectional side view of a water lock system in which the second chamber is filled with water.

FIG. 33 depicts a cross sectional side view of a water lock system in which participants are being transferred from the second chamber to the upper body of water.

FIG. 34 depicts a cross sectional side view of a water lock system in which participants are being transferred from the second chamber to the upper body of water and from the lower body of water to the first chamber.

FIG. 35 depicts an overhead view of a water park system which includes a lock system.

FIG. 36 depicts a cross sectional side view of a water lock system in which includes a chamber and three movable members, each movable member being at a different elevation.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawing and will herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

## DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 depicts a water lock system for conveying a person or a group of people (i.e., the participants) from a lower body of water **10** to an upper body of water **20**. It should be understood that while a system and method of transferring the participants from the lower body of water to the upper body of water is herein described, the lock system may also be used to transfer participants from an upper body to a lower body, by reversing the operation of the lock system. The upper and lower bodies of water may be receiving pools (i.e., pools positioned at the end of a water ride), entry pools (i.e., pools positioned to at the entrance of a water ride), another chamber of a water lock system, or a natural body of water (e.g., a lake, river, reservoir, pond, etc.). The water lock system, in one embodiment, includes at least one chamber **30** coupled to the upper and lower bodies of water. First movable member **40** and second movable member **50** may be formed in an outer wall **32** of the chamber. First movable member **40** may be coupled to lower body of water **10** such that the participants may enter chamber **30** from the lower body of water while the water **35** in the chamber is at level **37** substantially equal to upper surface **12** of the lower body of water. After the participants have entered chamber **30**, the level of water within the chamber may be raised to a height **39** substantially equal to upper surface **22** of upper body of water **20**. Second movable member **50** may be coupled to upper body of water **20** such that the participants may move from chamber **30** to the upper body of water after the level of water in the chamber is raised to the appropriate height.

Outer wall **32** of chamber **30** may be coupled to both lower body of water **10** and upper body of water **20**. Outer wall **32** may extend from a point below upper surface **12** of lower body of water **10** to a point above upper surface **22** of upper body of water **20**. Outer wall **32** may be formed in a number of different shapes, as depicted in FIGS. 2-5. Outer wall **32** of the chamber may, when see from an overhead view, be in a rectangular shape (FIG. 2), a U-shape (FIG. 3), a circle (FIG. 4), an L-shape (FIG. 5), as well as a number of other shapes not depicted, including, but not limited to, a square, a star, other

regular polygons (e.g., a pentagon, hexagon, octagon, etc.), a trapezoid, an ellipse, a Y-shape, a T-shape, or a figure eight.

Returning to FIG. 1, first movable member **40** may be in contact with lower body of water **10**. First movable member **40** may extend from a position below upper surface **12** of lower body of water **10** to a point above upper surface **12**. First movable member **40** may extend from a position below the upper surface of lower body of water **10** to the top **17** of outer wall **32**. First movable member **40** may be formed in a portion of outer wall **32** which is substantially shorter then the vertical length of the wall. In one embodiment, first movable member **40** extends to a depth below upper surface **12** such that participants may easily enter the chamber without contacting the lower surface **42** of the first movable member. If participants are to be able to walk into the chamber, first movable member **40** may extend to the bottom **34** of chamber **30**. Thus, participants may enter the chamber without tripping over a portion of outer wall **32**. In one embodiment, the participants will enter the chamber while floating at or proximate the upper surface **12** of the water. The lower surface **42** of first movable member **40** may be positioned at a depth of between about 1 foot to about 10 feet below upper surface **12** of lower body of water **10**, more preferably at a depth of between about 2 feet to about 6 feet from upper surface **12**, and more preferably still at a depth of between about 3 feet to about 4 feet from upper surface **12**. As the participants float from lower body of water **10** into chamber **30**, they may pass over lower surface **42** of first movable member **40** with little or no contact with the lower surface of the movable member.

Second movable member **50** may be in contact with upper body of water **20**. Second movable member **50** may extend from a position below upper surface **22** of upper body of water **20** to a point above upper surface **22**. Second movable member **50** may extend from a position above upper surface **22** of lower body of water **20** to the bottom **34** of chamber **30**. Second movable member **50** may be formed in a portion of outer wall **32** which is substantially shorter then the vertical length of the wall. Second movable member **50** may be formed at a position in outer wall **32** such that participants may move

from chamber **30** to upper body of water **20**, when water **35** within the chamber is at the appropriate level. In one embodiment, second movable member **50** extends to a depth below upper surface **22** of upper body of water **20** to allow participants to enter the upper body of water without contacting lower surface **52** of the second movable member. The participants may enter the upper body of water while floating at or proximate the upper surface **39** of the water within the chamber **30**. The lower surface **52** of second movable member **50** may be positioned at a depth of between about 1 foot to about 10 feet from upper surface **22** of upper body of water **20**, more preferably at a depth of between about 2 feet to about 6 feet from upper surface **22**, and more preferably still at a depth of between about 3 feet to about 4 feet from upper surface **22**. As the participants float from chamber **30** to upper body of water **20**, they may pass over lower surface **52** of second movable member **50** with little or no contact.

In one embodiment, water may be transferred into and out of chamber **30** via movable members **40** and **50** formed within outer wall **32**. Opening of the movable members **40** and **50** may allow water to flow into chamber **30** from the upper body of water **20** or out of the chamber into lower body of water **10**. Control of the movable members **40** and **50** may allow chamber **30** to be filled and lowered as needed.

In another embodiment, a conduit **60** may be coupled to chamber **30**. Conduit **60** may be configured to introduce water from a water source into chamber **30**. A water control system **62** may be positioned along conduit **60** to control flow of water through the conduit. Water control system **62** may be a valve which is configured to control the flow of water from a pressurized water source to chamber **30** during use. Water control system **62** may also include a pump, as described later, for increasing the flow rate of water flowing through conduit **60**.

In one embodiment, conduit **60** may be coupled to upper body of water **20**. Conduit **60** may be configured to allow water from upper body of water **20** to be transferred to chamber **30**. Water control system **62** may be used to control the transfer of

water from upper body of water **20** to chamber **30**. In one embodiment, conduit **60** is positioned such that an outlet **64** of the conduit enters chamber **30** at a position below upper body of water **20**. In this manner, upper body of water **20** may act as a pressurized water source for the supplying water to chamber **30**. In this embodiment, the water control system **62** may be a simple two way valve. To fill chamber **30**, the valve may be adjusted to an open position, allowing water from upper body of water **20** to enter the chamber. When a desired amount of water has entered chamber **30**, the valve may be closed to inhibit further passage of water from upper body of water **20** to the chamber.

A bottom member **70** may be positioned within chamber **30**. Bottom member **70** may be configured to float at a position below upper surface **37** of water **35** in chamber **30**. As chamber **30** is filled with water, bottom member **70** will rise toward the top of the chamber. In one embodiment, bottom member **70** remains at a substantially constant distance from upper surface **37** of water **35** as the water rises within chamber **30**. Bottom member **70** may remain at a distance of less than about 6 feet from upper surface **37** of water **35**, preferably at a distance of less than about 4 feet from upper surface **37**, and more preferably at a distance of less than about 3 feet from upper surface **37**.

During operation, chamber **30** is filled with water to elevate the participants to a level commensurate with the level of water in upper body of water **20**. As the level of water **35** in chamber **30** increases, some participants may become apprehensive or upset once the level of water passes a depth which is over the participants' heads. This may especially be true for younger or less experienced swimmers. To assuage the fears of these participants, bottom member **70** may be positioned at a depth below the surface of the water such that most or all of the participants may easily stand upon the bottom member as the water begins to rise. In this manner, the participants will be lifted by the incoming water, while feeling confident that if they should tire or fall off a flotation device they may rest upon bottom member **70**. Bottom member **70** may also reduce the risk of participants drowning. If a participant becomes fatigued or separated from their flotation device, the position of bottom member **70** will ensure that the participant will

always be able to stand with their head above or near upper surface **37** of water **35** if desired.

An automatic control system **80** may be coupled to the water lock system. The controller **80** may be a computer, programmable logic controller, or any of other known controller systems known in the art. The controller may be coupled to water control system **62**, first movable member **40**, and second movable member **50**. The controller may control the operation of the first and second movable members and the operation of the water control system. A first movable member operating mechanism **41** may be coupled to first movable member **40** to allow automatic opening and closing of the first movable member. The controller may send signals to first movable member operating mechanism **41** to open first movable member **40**, while maintaining second movable member **50** and water control system **62** in closed positions. After the participants have entered the chamber, the controller may signal first movable member operating mechanism **41** to close first movable member **40** and signal water control system **62** to allow water to enter chamber **30**. The controller may be configured to allow the water to flow into chamber **30** for a predetermined amount of time. Alternatively, sensors **38** for determining the level of the water **35** within chamber **30** may be positioned on an inner surface of outer wall **32**. In one embodiment, sensors **38** are positioned at various heights along outer wall **32**. When water **35** within chamber **30** reaches sensors **38**, the sensors may produce a signal to automatic controller **80** which indicate the current height of the water within the chamber. A second movable member operating mechanism **51** may be coupled to second movable member **50** to allow automatic opening and closing of the second movable member. After the water has reached the desired level, automatic controller **80** may be configured to signal water control system **62** to stop the flow of water to chamber **30** and second movable member operating mechanism **51** to open second movable member **50** allowing the participants to move to upper body of water **20**.

First movable member **40** and/or second movable member **50** may be a swinging door, as depicted in FIG. 6. The movable members may include a single door, or,

preferably a pair of doors **53a** and **53b**. The doors may be coupled to outer wall **32** by a hinge **54**. Hinge **54** allows the doors to swing away from outer wall **32** when moving from a closed to an open position. An "open position" is a position which allows water and/or participants to be transferred through the movable member. A "closed position" is a position which inhibits passage of water and/or participants through the movable member. The doors **53a/b** may swing into chamber **30** or away from chamber **30**. If two doors are used a divider **55** may be positioned between the two doors **53a/b**. Divider **55** may serve as a support to help maintain doors **53a/b** in a closed position. A hydraulic movable member operating system **51** (see FIG. 1) may be coupled to doors **53a/b** to facilitate opening and closing of the doors during use. Doors **53a/b** may have a length which is substantially equal to the vertical length of outer walls **32**. Doors **53 a/b** may have a vertical length of between about 3 to about 6 feet, preferably a vertical length of between about 3 feet to about 4 feet.

In another embodiment, depicted in FIGS. 7-9, first movable member **40** and/or second movable member **50** may be a door **43** configured to move vertically into a portion of outer wall **32**. As depicted in FIG. 8, when door **43** moves from a closed position (See FIG. 7) to an open position (see FIG. 9) the door may be moved into a cavity **44** formed in outer wall **32**. In FIG. 8, door **43** is configured to move down into cavity **44** when moving into an open position. A hydraulic movable member operating system **41** (see FIG. 1), or similar devices, may be positioned within outer wall **32** to move the door up or down. The door preferably has a vertical length of between about 3 feet to about 6 feet, more preferably a vertical length of between about 3 feet to about 5 feet.

When a movable member, is positioned near an upper body of water, the movable member may be lowered into the wall (as depicted in FIGS. 7-9). When a movable member is positioned near a lower body of water the door of the movable member may be formed in the middle of the wall, or near the bottom of the wall. In this case, the movable member may be moved from a closed position to an open position by moving

the movable member in an upward or downward direction.

In another embodiment, depicted in FIGS. 10-11, the movable members may be a single door, or, as depicted, a pair of doors **47**, configured to move horizontally into a cavity **48** formed in outer wall **32**. When doors **47** move from a closed position (depicted in FIG. 10) to an open position (depicted in FIG. 11) the doors may be moved into cavity **48**. As depicted in FIG. 11, the doors may be configured to move away from a central portion of the movable member along outer wall **32**, when moving into an open position. A hydraulic system, or similar system, may be positioned within cavity **48** or upon outer wall **32** to move the door. The door may have a vertical length of between about 3 feet to about 6 feet, more preferably a vertical length of between about 3 feet to about 5 feet.

Referring to FIG. 11, the horizontally movable doors **47** are depicted near the lower body of water. Doors **47** are depicted in an open position. While in this position, the doors may reside in cavity **48**, leaving opening **49** through which the participants may pass from lower body of water **10** to chamber **30** or from chamber **30** to lower body of water **10**. When the participants are to be moved to an upper body of water, doors **47** may be moved into a closed position, as depicted in FIG. 10 and the chamber may be filled with water.

The movable members may be any combination of sliding or swinging doors. For example, all of the movable members may be vertically sliding doors. Alternatively, the lower movable member may be horizontally sliding doors while the upper movable member may be vertically sliding doors. An advantage to using sliding doors or small hinged doors is that the amount of power necessary to move such doors may be minimized. In a typical lock system, such as those used to move ships, the entire wall of the lock system is typically used as the movable member. Thus, a hydraulic system which is capable of opening a massive movable member may be required. Such systems tend to be relatively slow and may require large amounts of power to operate. For the purposes of moving people, the doors only need to be large enough to comfortably move

a person from one body of water to the next. Thus, much smaller doors may be used. A further advantage of sliding doors is that the movement of the doors (either horizontally or vertically) is not significantly inhibited by water resistance. The sliding doors may also be safer than swinging doors, since a swinging door may swing into a participant during the opening or closing of the movable member.

Turning to FIG. 12, a substantially water permeable bottom member **70** is depicted. By making bottom member **70** water permeable, water may flow through the bottom member with little resistance, thus allowing the bottom member to easily move through the water in chamber **30**. In one embodiment, a number of openings are formed in bottom member **70** to allow water to pass through the bottom member. The openings may be in any shape, including, but not limited to a square, circular, rectangular, regular polygon, star, or an oval. In one embodiment, the openings have a shape and size that allows water to freely move through the openings, while inhibiting the participants from moving through the openings.

In one embodiment, bottom member **70** is composed of a grid of elongated members as depicted in FIG. 12. The spacing of the elongated members is such that participants, as well as the arms, legs, hands, feet, heads, etc. of the participants, are inhibited from passing through any of the openings formed by the grid.

Bottom member **70**, in one embodiment, includes a wall **71** formed along the perimeter of the bottom member. Wall **71** may extend from the bottom member toward the top of chamber **30**. Wall **71** may extend above the surface of the water **35** in the chamber during use. The wall may be configured to extend to a height such that the participants are inhibited from moving to a position below bottom member **70**. In this configuration, bottom member **70** may act as a "basket" which ensures that the participants remain at or near the upper surface of the water **35** in chamber **30** at all times. Wall **71** may extend above the surface of the water by a distance of between about 2 to about 6 feet, preferably by a distance of between about 2 ½ to about 5 feet, and more

preferably by a distance of between about 3 to 4 feet.

Movable members **72** and **73** may be formed in wall **71** of bottom member **70**. Movable members **72** and **73** may be formed at a location in wall **71** such that they correspond with the position of the first movable member **40** and the second movable member **50** formed in outer wall **32** of the chamber, when the bottom member is at a level proximate one of the first or second movable members. For example, as depicted in FIG. 12, movable member **72** of the bottom member is positioned in wall **71** of the bottom member at a level approximately equal to the second movable member **50**, when water **35** in chamber **30** is substantially equal to the water level in upper body of water **20**. This may allow participants to easily exit through wall **71**, via movable member **72** and through second movable member **50** when moving from chamber **30** to upper body of water **20**. In a similar manner, movable member **73** may be positioned at a level approximately equal to first movable member **40**, when water **35** in the chamber is lowered. Movable members **72/73** may extend over the entire vertical length of wall **71** of the bottom member. In one embodiment, movable members **72/73** extend from about 1 to 3 feet below the surface of the water to 1 to 3 feet above the surface of the water, preferably from about 1 ½ to about 2 feet above and below the upper surface of the water.

Bottom member **70** may be configured to remain at a substantially constant distance from the upper surface **37** of the water in chamber **30** as the water level is adjusted within the chamber. In one embodiment, depicted in FIG. 13, flotation members **75** may be placed on wall **71** to provide buoyancy to bottom member **70**. By placing floatation members **75** at a location between the bottom member **70** and the top of wall **71** the level at which the bottom member remains below the surface may be maintained. For example, by placing flotation members **75** at a position approximately three feet from the bottom of wall **71**, bottom member **70** may be maintained at a position of at least about 3 feet below the surface of the water. In one embodiment, flotation members **75** are placed on wall **71** at a position such that the bottom member remains about 3 feet below the upper surface of the water and such that wall **71** extends about 3 feet above the

surface of the water.

Turning to FIG. 14, bottom member **70** may also include a ladder **76** extending along a vertical portion of wall **71** of the bottom member. Ladder **76** may extend from the bottom member (not shown) to the top of wall **71**. A complimentary ladder **78** may be formed on an inner surface of the outer wall **32** of the chamber. The complementary ladder **78** may extend the entire vertical height of the chamber and is substantially aligned with the ladder **76** of the bottom member. As the bottom member is raised or lowered ladder **76** and ladder **78** may remain substantially aligned such that at any give time participants may exit the chamber by climbing up the ladders **76** and **78**. In the event that the chamber cannot be properly filled, the ladders **76** and **78** may allow the participants to exit the chamber. Thus, the ladder system may act help to prevent participants from becoming trapped within the chamber in the event of a breakdown of the lock system.

In an embodiment, bottom member **70** is preferably coupled to outer wall **32** by at least one guide rail **80** formed on the inner surface of the outer wall, as depicted in FIG. 15. An engaging member **82** may couple bottom member **70** to guide rail **80**. Engaging member **82** may substantially surround a portion of guide rail **80** such that the engaging member is free to move vertically along the guide rail, but is substantially inhibited from becoming detached from the guide rail. The coupling of bottom member **70** to guide rail **80** may reduce the bobbing movement of the bottom member while the bottom member is floating within the chamber. The engaging member **82** may also include a motor configured to move the bottom member vertically within the chamber. The use of a motor to move the bottom member, allows the bottom member to be moved without floating the bottom member.

A ratcheted locking system **84** may also be incorporated onto bottom member **70**. Ratchet locking system **84** includes a locking member **85** which is configured to fit into grooves **86** formed in the inner surface of outer wall **32**. Locking member **85** may include a protrusion **87** extending from the main body **88** configured to fit into grooves

**85**. The main body **88** may include a ratchet system **89** which forces protrusion **85** against outer wall **32**. A ratchet system may allow locking member **85** to rotate relatively freely in one direction, while allowing only a constrained rotation in the opposite direction. As depicted in FIG. 15, the locking member may be configured such that rotation in a clockwise direction is constrained. As bottom member **70** moves along up the wall the protrusion may be forced into one of the grooves **86** when aligned with a groove. As the bottom member **70** is forced up by the rising water, protrusion **87** may slide out of one groove **86** and into another groove. Protrusion **87** may extend from main body **88** of locking member **85** at an angle to facilitate removal of the protrusion from a groove **86** as bottom member **70** moves upward.

When the bottom member **70** moves in a downward direction, locking system **85** may inhibit the downward movement of the bottom member. As bottom member **70** moves downward, protrusion **87** may extend into one of grooves **86**. The locking member **85**, as described above, may only rotate for a limited distance in a clockwise direction. Thus, once protrusion **87** is extended into a groove **86**, the protrusion may lock bottom member **70** at that position, preventing further movement of the bottom member in a downward direction. The bottom member may be unlocked by raising the bottom member or via a release mechanism which is incorporated into the ratchet system **89**.

After a group of participants have moved to an upper body of water, the water level of the chamber, along with bottom member **70** may be lowered to pick up additional participants. To lower the bottom member, a release system may be incorporated into the ratchet system **89**. The release system may be configured to allow the locking system **85** to be moved into a position such that protrusion **87** no longer makes contact with the grooves **86**. This may allow the bottom member to be moved in a downward direction. In one embodiment, a flexible member **90** (e.g., a chain, rope, wire, etc.) may be attached to locking member **85**. To allow bottom member **70** to be lowered, flexible member **90** may be pulled such that the protrusion **87** is moved away from grooves **86** (i.e., the locking member is rotated in a counterclockwise direction, as depicted in FIG. 15).

Flexible member **90** may be manually or automatically operated.

A number of configurations may be used to control the input of water to the chamber, and the output of water from the chamber. Referring back to FIG. 1, a conduit **60** may be coupled to upper body of water **20** such that water from the upper body of water may be transferred into chamber **30**. The water may be removed by opening the first movable member **20** (either partially or fully) to remove the water from the chamber. Alternatively, water control system **62** may include a pump for pumping the water back to upper body of water **20**. As depicted in FIG. 16, a water control system may include a pump **64** and a diverter valve **66**. Conduit **63** may be coupled to the upper body of water, while conduit **65** may be coupled to the chamber. Diverter valve **66** may be a three way valve which allows water to pass through pump **64** or a bypass conduit **67**. When the chamber is to be filled diverter valve **66** may be set to allow water to pass through bypass conduit **67** and into the chamber. Alternatively, the valve may be switched to allow the pump **64** to increase the rate of water flow into the chamber. The water may be flowed through the conduit until the upper level of the water in the chamber is substantially equal to the upper level of the water in the upper body of water.

To lower the water level in the chamber, the diverter valve **66** may be switched to allow water to flow to pump **64**. The water may be pumped from the chamber back to the upper body of water until the level of the water in the chamber and the lower body of water are substantially equal. In the case when pump **64** is used to increase flow of water to the chamber and also to pump water back to the upper body of water, pump **64** may be a reversible pump. Alternatively, two separate pumps may be used to pump water in each direction. In this manner, water may be transferred from the chamber to the upper body of water and from the upper body of water to the chamber using the same conduit. In this embodiment, the amount of water transferred from the upper body of water to the lower body of water during multiple cycles of the lock system may be negligible.

Alternatively, two conduits may be used to transfer the water to and from the

chamber, as depicted in FIG. 17. A first conduit **160** may be coupled to an upper body of water **120** and a chamber **130**. First conduit **160** may include a first water control system **162**. The first water control system **162** may be a two-way valve. A second conduit **164** may also be coupled to upper body of water **120** and chamber **130**. The second conduit may include a second water control system **166**. The second water control system **166** may include a pump and a valve. To fill chamber **130** with water, the first water control system **162** may be set to allow water to flow from upper body of water **120** to chamber **130**. To lower the water level in chamber **130**, second water control system **166** may be opened, while closing first water control system **162**, such that the pump of the second water control system pumps water from the chamber back to upper body of water **120**.

These embodiments, where the water is transferred from and to the upper body of water may have an advantage when the upper and lower body of water require a preset amount of water to be maintained within the bodies of water during use. If excess water is transferred from the upper body of water to the lower body of water, the upper body of water may become depleted of water while the lower body of water may become overfilled. The transfer of the water from the upper body of water to the chamber and then back to the upper body of water from the chamber may alleviate this problem by maintaining both the upper and lower bodies of water at a substantially constant level over multiple cycles of the lock system.

In another embodiment, depicted in FIG. 18, the lower body of water **110** may be used to supply water into the chamber. A conduit **160** may be coupled to chamber **130** such that water from lower body of water **110** may be introduced into chamber **130**. A water control system **162** may be positioned along conduit **160**. Water control system **162** may include a diverter valve and a pump (e.g., as depicted in FIG. 16). When chamber **130** is to be filled, the diverter valve of water control system **162** may be adjusted to allow water to be pulled through the pump and into chamber **130**. The pump may fill chamber **130** with water by transferring water from lower body of water **110** to the chamber. To lower the water level in chamber **130**, the diverter valve may be coupled



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to a bypass conduit (see FIG. 16). The water is then forced through the bypass conduit by the water pressure differential between the chamber water and the lower body of water, until the level of water in chamber **130** is substantially equal to the level of water in lower body of water **110**.

Alternatively, two conduits may be used to transfer the water between the chamber **130** and the lower body of water **110**, as depicted in FIG. 19. A first conduit **160** may be coupled to lower body of water **110** and chamber **130**. A first water control system **162** may be positioned along the first conduit **160**. First water control system **162** may include a pump and a valve (e.g., as depicted in FIG. 16). A second conduit **164** may also be coupled to the lower body of water **110** and the chamber **130**. A second water control system **166** may be positioned along the second conduit **164**. Second water control system **166** may include a valve. To fill chamber **130**, first water control system **162** may be adjusted to allow water to be pumped from lower body of water **110** into chamber **130**, while second water control system **166** is in a closed position. To lower the water level in chamber **130**, second water control system **166** may be opened, while closing first water control system **162**, such that the water from chamber **130** is transferred to the lower body of water **110**.

In another embodiment, two conduits may be used to fill and empty the chamber, as depicted in FIG. 20. A first conduit **160** may be coupled to upper body of water **120** and chamber **130**. A second conduit **164** may be coupled to lower body of water **110** and chamber **130**. A first water control system **162** may be positioned along first conduit **160**. A second water control system **166** may be positioned along second conduit **164**. First water control system **162** may be a valve or a valve/pump system (see FIG. 16). To fill chamber **130**, first water control system **162** may be opened such that water flows from upper body of water **120** to chamber **130**. Second water control system **166** may be adjusted such that water is inhibited from flowing from chamber **130** to lower body of water **110**. In one embodiment, the water pressure differential between upper body of water **120** and the water in chamber **130** may be used to force water from the upper body

of water into the chamber. When the level of the water in chamber **130** is substantially equal to the level of water in upper body of water **120**, the water pressure differential will become nearly zero. Thus, the water may stop flowing into chamber **130** without having to close or adjust water control system **162**. Alternatively, a pump may be incorporated into water control system **162** and water may be pumped from upper body of water **120** to chamber **130**.

To empty chamber **130**, first water control system **162** may be adjusted such that water flow from upper body of water **120** to the chamber is inhibited. Second water control system **166** may be adjusted so that water in chamber **130** now flows through second conduit **164** and into lower body of water **110**. By relying on a water pressure differential, the water may automatically stop flowing into lower body of water **110** when the water level in chamber **130** is substantially equal to the water level in the lower body of water. Alternatively, water control system **166** may include a pump to increase the rate of water transfer from chamber **130** to lower body of water **110**.

An advantage of using two conduits in this manner to transfer water to and from the chamber is that there may be no need to use water level monitoring devices. Since the flow of water will automatically stop when the water level is at the desired level, no water monitoring devices may be necessary. This may allow a much simpler system to be built. Such a system may include water control devices which are simply two way valves to allow or inhibit the flow of water thorough the conduits. Such a system may be easily run manually, semi-automatically, or automatically. Semi-automatically is defined to mean when a human operator informs the automatic control devices when to open/close the valves.

A disadvantage of this two conduit system is that water is being transferred from upper body of water **120** to lower body of water **110**. After repeated cycles, the lower body of water may become overfilled with water while the upper body of water may become depleted of water. To prevent this from occurring a third conduit may be added

to the system. As depicted in FIG. 21, a lock system may include a first conduit **160** for transferring water from an upper body of water **120** to a chamber **130**, a second conduit **164** for transferring water from the chamber to a lower body of water **110**, and a third conduit **168** for transferring water from the lower body of water to the upper body of water. The first, second and third conduits may include first, second, and third water control systems **162**, **166**, and **170**. First and second water control systems may be similar in function to the water control systems described above. Third water control system **170** may include a pump for pumping water from lower body of water **110** to upper body of water**120**. During use first conduit **160** may be used to transfer water from upper body of water **120** to chamber **130**. To lower the level of the water in chamber **130**, water may be transferred from chamber **130** to lower body of water **110** via second conduit **164**. As described above, such a system may alter the level of water in the two bodies of water after repeated cycles. Once this situation occurs, the third conduit may be used to transfer water from lower body of water **110** to upper body of water **120**. The transfer of water from the lower to the upper body of water may occur at anytime during the cycle. In one embodiment, the transfer occurs as the water from chamber **130** is being transferred to lower body of water **110**. Thus, the level of water in both the upper and lower bodies of water may remain substantially constant over repeated cycles of the lock system.

The lock systems described above may be used to transfer participants from a lower body of water to an upper body of water while the participants remain in the water. The participants may be swimming in the water or may be floating upon the surface of the water with a flotation device. Examples of flotation devices include, but are not limited to inner tubes, floating boards, life jackets, life preservers, water mattresses, rafts and small boats.

As depicted in FIG. 22, a lock system, in one embodiment, includes a chamber **130** which is coupled to a lower body of water **110** and an upper body of water **120**. The level of water in chamber **130** is initially set to be substantially equal to the level of water

in lower body of water **110**. A first movable member **140** may be positioned in outer wall **132** of chamber **130** proximate the upper surface of water in the lower body of water. First movable member **140** is initially in an open position to allow participants to move from lower body of water **110** into chamber **130**. The participants may swim or propel their flotation device into chamber **130** via first movable member. In another embodiment, a water propulsion system **190** may be set up within lower body of water **110** to cause a current (denoted by the curved lines **192**) to be produced. The current may propel the participants toward movable member **140** from lower body of water **110**.

After the participants have entered chamber **130**, first movable member **140** may be closed, as depicted in FIG. 23 Water may be transferred from a water source into chamber **130** causing the water level within the chamber to rise. The water source may be lower body of water **110**, upper body of water **120**, and/or an alternate water supply source (e.g., a nearby water reservoir, river, lake, ocean, etc.). The water, in one embodiment, may be transferred into chamber **130** until the upper surface **137** of the water in the chamber is substantially equal to the upper surface of the water in upper body of water **120**. Thus, the participants may be raised from a lower level to an upper level as water is transferred into the chamber. A bottom member **170**, as described above, may also be raised as the water enters the chamber.

After the water in the chamber has reached a level substantially equal to the level of water in upper body of water **120**, the second movable member **150** may be opened as depicted in FIG. 24. Participants may then move from chamber **120** into upper body of water **130**. The participants may move using their own power or be propelled by a water propulsion system **194** incorporated on outer wall **132**.

In another embodiment, a current may be generated by continuing to fill chamber **130** with water after the level of water in the chamber is substantially equal to the level of water in upper body of water **120**. In an embodiment, second movable member **150** is opened when the level of water between the chamber **130** and the upper body of water

**120** are substantially equal. Additional water may be introduced into the chamber **130** such that the level of water in the chamber begins to rise above the level of water in the upper body of water **120**. As the water is pumped into the chamber **120**, the resulting increase in water volume may cause a water current to be formed flowing from the chamber to the upper body of water. The formed current may be used to propel the participants from the chamber to the upper body of water.

Overall, the participants may be moved from lower body of water **110** to upper body of water **120** while remaining in water during the entire transfer period. An advantage of this method of transfer is that the participants do not have to leave the water, thus allowing the participants to remain cool on hot days. The participants will no longer have to carry their flotation devices. Inner tubes and boards may be difficult for some younger riders to carry. By transferring people with a lock system, the need to carry flotation devices to the start of a water ride may be eliminated.

After the participants have been transferred to the upper body of water, the water level may be lowered by removing water from the chamber. The water may be removed until the water level is substantially equal to the water in the lower body of water. The first movable member may then be reopened to allow more participants to be transferred to the upper body of water. It should be understood that after a group of participants have been transferred to the upper body of water, another group may enter the lock system and be transferred to the lower body as the water within the chamber is lowered. It should also be understood that any of the previously described embodiments of the water lock system may be used to transfer participants between any number of bodies of water having different elevations.

In another embodiment, multiple chambers may be linked together to transfer participants from a lower body of water to an upper body of water. FIG. 25 depicts a water lock system **200** that, in one embodiment, includes two chambers for transferring participants from a lower body of water **205** to an upper body of water **210**. It should be

understood that while only two chambers are depicted, additional chambers may be positioned between the bodies of water and the following description would be applicable to such systems. A first chamber **220** may be coupled to lower body of water **205**. A portion of first chamber **220** may extend below the upper surface of lower body of water **205**. A second chamber **230** may be coupled to first chamber **220** and upper body of water **210**. A portion of outer wall **222** of first chamber **220** may also form a portion of the outer wall of second chamber **230**. Bottom members **270** and **272**, as previously described, may be positioned within the first and second chambers respectively.

A first movable member **240** may be formed adjacent to lower body of water **205**. First movable member **240** may extend from a position below the upper surface of lower body of water **205** to a point above the upper surface of the lower body of water. First movable member **240** may extend over the entire vertical length of the outer wall **222** of first chamber **220**. In one embodiment, first movable member **240** is formed in a portion of outer wall **222** that is substantially shorter than the vertical length of the outer wall. The first movable member may be a swinging movable member or a sliding movable member as previously described.

A second movable member **245** may be formed in outer wall **224** of first chamber **220** adjacent to second chamber **230**. Second movable member **220** may extend from a point above the bottom member of second chamber **230** toward the top of first chamber wall **224**. Second movable member **245** may be positioned to allow participants to enter second chamber **230** from first chamber **220**, while the water level is elevated within the first chamber. Second movable member **245** may be a swinging movable member or a sliding movable member as previously described.

A third movable member **250** may be formed adjacent upper body of water **210**. Third movable member **250** may extend from a position below the upper surface of upper body of water **210** to a point above the upper surface. Third movable member **250** may be formed in a portion of outer wall **232** which is substantially shorter then the vertical

length of the wall. Third movable member **250** may be formed at a position in outer wall **232** such that participants may move from second chamber **230** to upper body of water **210** when the water within the second chamber is substantially level with the water in the upper body of water. Third movable member **250** may extend to a depth below the upper surface of upper body of water **210** to allow participants to easily enter the upper body of water without contacting the lower surface of the third movable member.

Conduits **260** and **262** may be positioned to introduce water into first chamber **220** and second chamber **230**, respectively. Water control systems **262** and **266** may be positioned along conduits **260** and **264**, respectively, to control flow of water through the conduits. Water control systems **262** and **266** may include a valve which is configured to control the flow of water from a pressurized water source to the chamber. Water control systems **262** and **266** may also include a pump for increasing the flow rate of water through the conduits.

An automatic controller **280** may be coupled to the lock system. The controller may be a computer, programmable logic controller, or any other known controller system. The controller may be coupled to water control systems **262** and **266** and movable members **240, 245,** and **250**. The operation of the movable members and the water control systems may be coordinated by the controller such that the proper timing of events occurs. Sensors **290** and **292** may be positioned on the inner surface of the first chamber **220** and the second chamber **230**, respectively, to relay the level of water within the chambers back to control system **280**.

In one embodiment, first conduit **260** and second conduit **264** may be coupled to upper body of water **210**. The first and second conduits, **260** and **264** may be configured to allow water from upper body of water **210** to be transferred to first chamber **220** and second chamber **230** respectively. First water control system **262** may be used to control the transfer of water from upper body of water **210** to first chamber **220**. Second water control system **266** may be used to control flow of water from upper body of water **210** to

second chamber **230**. The water control systems **262** and **266** may include a pump, a valve and a bypass conduit, as depicted in FIG. 16. The operation of this type of water control system has been previously described.

To lower the water level in either of the chambers, the water control systems **262** and **266** may include a pump for pumping water from the first chamber **220** and the second chamber **230** respectively. The water may be pumped from the chambers back to upper body of water **210** during use. In this manner, each of conduits **260** and **264** may allow the water to be transferred from upper body of water **210** to the chambers **220** and **230**, respectively, and from the chambers back to the upper body of water. An advantage of these embodiments is that the water level in both the upper and lower bodies of water remains substantially constant over multiple cycles of the water lock system.

In another embodiment, depicted in FIG. 26, lower body of water **205** may be used to supply water into the first and second chambers **220** and **230**. The first conduit **260** and second conduit **264** may be coupled to chambers **220** and **230** such that water from lower body of water **205** may be introduced into the chambers. Water control systems **262** and **266** (e.g., as depicted in FIG. 16), are positioned along conduits **260** and **264**, respectively. Each of water control systems **262** and **266** may include a pump. When a chamber is to be filled, the appropriate water control system may direct water from lower body of water **210** to a pump. The pump may fill the chamber with water by pumping water from lower body of water **210** to the chamber. To lower the water level in a chamber, the water control system may be adjusted to allow water to flow back into the lower body of water.

In another embodiment, three conduits may be used to transfer water between the upper body of water **310**, the chambers **320** and **330**, and the lower body of water **305**, as depicted in FIG. 27. A first conduit **364** may be coupled to first chamber **320** and second chamber **330**. A first water control system **366** may be positioned along first conduit **364**. First conduit **364** may be configured to transfer water from second chamber **330** to first

chamber **320**. A second conduit **360** may be coupled to upper body of water **310** and second chamber **330**. Second conduit **360** may include a second water control system **362**. Second conduit **360** may be configured to transfer water from upper body of water **310** to second chamber **330**. A third conduit **361** may be coupled to first chamber **320** and lower body of water **305**. Third conduit **361** may include a third water control system **363**. Third conduit **361** may be configured to transfer water from first chamber **320** to lower body of water **305**. The first, second, and thirds water control systems may include a valve or a pump/valve system (e.g., the system of FIG. 16).

As noted before, a disadvantage of this type of lock system is that water is being transferred from the upper body of water to the lower body of water. After repeated cycles the lower body of water may become overfilled while the upper body of water may become depleted. In an embodiment, a fourth conduit may be added to the system to transfer water from the lower body of water back to the upper body of water. Fourth conduit **365** may include a fourth water control system **367**. Fourth water control system **367** may include a pump for pumping water from lower body of water **305** to upper body of water **310**. The transfer of water from lower body of water **305** to upper body of water **310** may occur at anytime during the cycle. The transfer of water from the lower body of water to the upper body of water may occur as water from first chamber **320** is being transferred to lower body of water **305**. Thus, the level of water in both the upper and lower bodies of water may remain substantially constant over repeated cycles of the lock system.

In another embodiment, four conduits may be used to fill and empty the chambers, as depicted in FIG. 28. A first conduit **460** may be coupled to upper body of water **410** and to first chamber **420**. A second conduit **464** may be coupled to upper body of water **410** and second chamber **430**. The first and second conduits may be configured to allow transfer of water from upper body of water **410** to the first and second chambers, respectively. First and second water control system **462** and **466** may be positioned along the first and second conduits, respectively. A third conduit **461** may be coupled to first

chamber **420** and lower body of water **405**. A fourth conduit **465** may be coupled to lower body of water **405** and second chamber **430**. The third and fourth conduits may be configured to allow the transfer of water from the first and second chambers respectively to the lower body of water. Third and fourth water control systems **463** and **467** may be positioned along the third and fourth conduits respectively. The water control systems may include a valve or a valve/pump system (e.g., as depicted in FIG. 16). An advantage of this type of system is that the first and second chambers may be independently emptied or filled.

A fifth conduit **468** may be added to the system. Fifth conduit **468** may include a fifth water control system **469**. Fifth water control system **469** may include a pump for pumping water from lower body of water **405** to upper body of water **410**. The transfer of water from lower body of water **405** to upper body of water **410** may occur at anytime during the cycle. The transfer of water from the lower body of water to the upper body of water may occur as water from first chamber **420** is being transferred to lower body of water **405**. Thus, the level of water in both the upper and lower bodies of water may remain substantially constant over repeated cycles of the lock system.

The multiple lock systems described above may be used to transfer participants from a lower body of water to an upper body of water in stages while the participants remain in the water. The participants may be swimming in the water or may be floating upon the surface of the water with a flotation device. Examples of flotation devices include, but are not limited to inner tubes, floating boards, life jackets, life preservers, and air mattresses and small boats. By using multiple chambers, a series of smaller chambers may be built rather than a single large chamber. For example, if an elevation change of 100 feet is required a single 100 foot chamber may be built or four coupled 25 foot chambers may be built. In some situations it may be easier to build a series of chambers rather than a single chamber. For example, use of a series of smaller chambers may better match the slope of an existing hill than a large single chamber. Additionally, the chambers may be formed independently of each other. For example, a series of chambers

may be used, with a channel or canal connecting each of the chambers, rather than the chambers being integrally formed as depicted in the embodiments above.

A method of using a multiple chamber system is described below. As depicted in FIG. 29, a lock system may include a first chamber **220** which is coupled to a lower body of water **205** and a second chamber **230** coupled to the first chamber and an upper body of water **210**. While only two chambers are shown it should be understood that additional chambers may be positioned between the first and second chambers and that the below described method would be applicable to such multiple chamber systems. The level of water in first chamber **220** may be initially set to be substantially equal to the level of water in lower body of water **205**. A first movable member **240** may be formed in outer wall **222** of first chamber **220** proximate the upper surface of lower body of water **205**. First movable member **240** may, initially, be in an open position to allow participants to move from lower body of water **205** into the first chamber. The participants may swim or propel their flotation device into the chamber via the first movable member. Alternatively, a water current, as previously described, may be produced to push the participants toward the first chamber from the lower body of water.

After the participants have entered first chamber **220**, first movable member **240** may be closed, as depicted in FIG. 30. Water may be transferred from a water source into first chamber **220** causing the water level within the first chamber to rise. The water source may be the lower body of water, the upper body of water, and/or an alternate water supply source (e.g., a nearby water reservoir, river, lake, ocean, etc.). The water may be transferred into first chamber **220** until the water level in the chamber is substantially equal to the level of water in second chamber **230**. Second movable member **245** may be positioned at a level above the bottom of second chamber **230**. Second chamber **230** may be filled with water to a level equal to a portion of second movable member **245**. Thus, the participants may be raised from lower body of water **205** to an intermediate level as water is transferred into the first chamber. A bottom member **270**, as described above, may also be raised as the water enters the chamber.

After the water in first chamber **220** has reached a level substantially equal to the water in second chamber **230**, second movable member **245** may be opened as depicted in FIG. 31. Participants may move from first chamber **220** into second chamber **230**. The participants may move into second chamber **230** using their own power or be propelled by a water current.

After the participants have entered second chamber **230**, second movable member **245** may be closed, as depicted in FIG. 32. Water may be transferred from a water source into second chamber **230** causing the water level within the second chamber to rise. The water may be transferred into the chamber until the water level in second chamber **230** is substantially equal to the level of water in upper body of water **210**. Thus, the participants may be further raised from an intermediate level to upper body of water **210** as water is transferred into second chamber **230**. A bottom member **272**, as described above, may also be raised as the water enters the second chamber.

After the water in second chamber **230** has reached a level substantially equal to the water in upper body of water **210**, third movable member **250** may be opened as depicted in FIG. 33. Participants may then move from second chamber **230** into upper body of water **210**. The participants may move using their own power or be propelled by a water current into upper body of water **210**. Overall, the participants may be moved from a lower body of water to an upper body of water while remaining in water during the entire transfer period.

After the participants are transferred to upper body of water **210**, the water level in the both chambers may be lowered. In one embodiment, the water in both chambers may be lowered at the same time. This allows both chambers to be reset to the original starting water levels (e.g., as depicted in FIG. 29). The water within first chamber **220** may be set at a level about equal to lower body of water **205**. The water within second chamber **230** may be set at a level proximate second movable member **245**. After the

water level is reduced, first movable member **240** may be reopened to allow more participants to be transferred into the lock system.

Alternatively, the filling and emptying of the chambers may be offset to allow a more efficient usage of a multiple chamber system. After participants have moved from first chamber **220** to second chamber **230**, the first chamber may be emptied while the second chamber is filled, as depicted in FIG. 34. After second chamber **230** is filled, third movable member **250** is opened and the participants may move into upper body of water **210**. While the participants are being transferred to upper body of water **210**, additional participants may enter first chamber **220**. Once the participants have entered first chamber **220** and left second chamber **230**, the water level in the first chamber may be raised while the water in the second chamber is lowered (see FIG. 31). The system may thereafter be cycled between the states depicted in FIGS. 31 and 34 to continually transfer participants from the lower body of water to the upper body of water. It should be understood that while a method of transferring the participants from the lower body of water to the upper body of water is described, the lock system may also be used to transfer participants from an upper body to a lower body. Thus, after a group of participants have been transferred to the upper body, another group may enter the lock system and be transferred to the lower body as the water within the chambers is lowered.

Referring back to FIGS. 3-5 it should be appreciated that multiple movable members may be formed in the chamber. FIG. 3, for example, depicts a U-shaped chamber which includes three movable members. The movable members may lead to three separate bodies of water or three locations of the same upper body of water. FIGS. 4 and 5 also depict chambers having multiple movable members. In this manner, the chamber may be used to transfer participants from a receiving pool to multiple water rides.

FIG 35 depicts an overhead view of a water park, in which two water rides are depicted which start at different locations. A first water ride **580** is configured to convey

participants from a first upper body of water **570** to a receiving pool **505**. A second water ride **590** is configured to convey participants from a second upper body of water **560** to receiving pool **505**. Receiving pool **505** may be positioned at an elevation below the first and second upper bodies of water. A water lock system **500** preferably couples receiving pool **505** to first and second upper bodies of water **560** and **570**. Participants exiting either water ride will preferably enter receiving pool **505**. The participants may propel themselves, or be propelled, through the water of the receiving pool over to movable member **510**. When movable member **510** is open, participants may enter chamber **550** of water lock system **500**. After entering chamber **550**, the chamber may be filled with water to a level which is substantially equal to the upper bodies of water. As the chamber is filled participants may propel themselves, or be propelled to either of the two upper movable members **520** and **530**. After the chamber is filled, movable members **520** and **530** may be opened allowing the participants to move to the start of either water ride. Thus, a centrally disposed water lock system **500** may allow the participants to enjoy a variety of water rides without having to leave the water. Any of the previously described water lock systems may be incorporated into the water park system.

It should be understood that the additional movable members do not need to be at the same vertical height along the chamber wall. As depicted in FIG. 36 some water rides may have starting points at different elevations. To accommodate these different elevations, movable members may be formed at different heights within the chamber, each elevation corresponding to a ride or series of rides which have starting points at about that elevational height. As depicted in FIG. 36, three bodies of water may be coupled by a water lock system **600**. A receiving pool **610** is formed at the base of the water lock system **600**. Receiving pool **610** may be positioned to receive participants exiting from various water rides. A first movable member **650** may be formed proximate receiving pool **610** to allow participants from the receiving pool to enter chamber **640**. After the participants enter chamber **640**, the chamber may be filled with water. The water level may be raised until the water level is at a level substantially equal to the water level of a first upper body of water **620**. Participants which desire to ride water rides

which are coupled to first upper body of water **620** may now leave chamber **640** via movable member **660**. Other riders who wish to ride water rides coupled to a second, higher elevation body of water **630** may remain in chamber **640**. After some of the participants have been transferred to first upper body of water **660**, the water level of the chamber may be further raised to a level substantially equal to the water level of second upper body of water **630**. The remaining participants may now enter second upper body of water **630** via movable member **670**. In this way the water lock system may accommodate water rides starting at different elevational levels. While only two upper bodies of water are depicted, it should be understood that additional movable members at additional heights may be disposed in the walls of the chamber to allow additional water rides to be coupled to a centrally disposed water lock system.

Further modifications and alternative embodiments of various aspects of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the general manner of carrying out the invention. It is to be understood that the forms of the invention shown and described herein are to be taken as the presently preferred embodiments. Elements and materials may be substituted for those illustrated and described herein, parts and processes may be reversed, and certain features of the invention may be utilized independently, all as would be apparent to one skilled in the art after having the benefit of this description of the invention. Changes may be made in the elements described herein without departing from the spirit and scope of the invention as described in the following claims.